TAB C

27 July 1965

MEMORANDUM FOR THE RECORD

SUBJECT: Electrocolor-Printer-Processor

PRELIMINARY REPORT

1. Introduction

The Electrocolor Printer-Processor produces positive color prints from color negatives in less than five minutes. The electrocolor processor is a unitized machine, which incorporates the necessary components to print and process full color projection prints up to $8\frac{1}{2}$ x 11 inches from $2\frac{1}{4}$ square to 4 x 5 inch negatives.

2. Concept

Three separate and distinct latent images are formed during three separate exposures and plating operations. The individual exposures are made through red, green, and blue separation filters. After each exposure, the latent image is converted to a complimentary color dye image by electroplating in the proper dye bath. The red exposure is plated in a cyan dye, the green exposure is plated in a magenta dye, and the blue exposure is plated in a yellow dye. The emulsion is resensitized after each plating operation, permitting all three dyes to be plated on a single emulsion layer. The special single emulsion is coated on an aluminum coated Mylar base; the aluminum being necessary to conduct the current in the electro plating process. The contrast and color balance of the individual colors can be controlled by varying the exposure and plating times.

3. Description of Test Equipment

a. The present model of the Electrocolor Printer-Processor is a single, automatic machine containing all necessary printing and processing components. The printing component rides on a horizontal bed and is motor driven along this bed, to change the image projection magnification. The print material is kept in a vertical plane on a specially built platen, permitting the dye buckets to ride up and submerge the print material in the dye during the plating operation.

b. Physical Specifications Are: Length: 98 inches, Width: 37 inches, Height: 54 inches, Weight: 1500 lbs.

c. Service Requirements Are:

Electrical - 3 phase, 60 cycle, 208 volt AC, 40 amp service
Water - 160°F and 60°F deionized water supply
Air - Dry, oil-free, compressed air at 90 lbs/square inch.

4. Discussion

The following advantages and disadvantages of the electrocolor printer-processor were arrived at by a series of tests performed by the PSD/Photographic Laboratory and are based on a comparison with the standard ektacolor paper-print process:

a. Advantages

(1) The electrocolor process is rapid for the production of a single color print, producing a fully dried print in approximately four minutes.

(2) The processing chemistry and the control there of are very simple requiring only the proper dilution of the three dyes with distilled water. The frequent chemical analysis normally required of other color processes is not required by the electrocolor process. The nature of the dye baths do not appear to change with age; replenishment is required only to maintain the solution level in the dye buckets.

(3) Durability:

Because of the aluminum coated Mylar base, and a plastic covering applied after plating, the print has great physical endurance and is highly resistant to curl, abrasion, scratches, fading, and water marks.

(4) Contrast Control:

Due to the nature of the electrocolor process, the plating time of each color can be varied, according to the need to control the contrast of each color, through a wide latitude. The plating time of the electrocolor process is analogous to the processing time of the ektacolor process. The time in the ektacolor process is maintained constant and does not permit contrast control as in the electrocolor process.

b. Disadvantages

(1) Optical System:

The optical system of the electrocolor printer-processor, according to an evaluation performed by [redacted] on a particular electrocolor test model, is only capable of reproducing 57 lines/mm. This system is considerably below the recording detail that we expect our color aerial films will contain within the next few years. The condensor-negative carrier system produces a sharp image of dust. Excessive cleaning time is required to minimize the effect of dust. The machine has no provision for interchangeable lenses and therefore has limited magnification capabilities.

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(2) Limited Size Capability - The present design of the electrocolor printer-processor has a maximum negative size of only 4 x 5 inches. The maximum print size is only $8\frac{1}{2}$ x 11 inches.

(3) Limited Output Capacity - The present system is impractical for large quantity runs from the same negative, as successive prints require the same production time as the first print.

(4) Local Print Control - The existing physical design of the machine does not permit the use of local print controls such as "dodging" and "burning in" which are respectively the process of holding back or giving additional exposure to selective print areas.

c. Color Quality - Tests run by the Center's laboratory indicated that the color saturation and fidelity, although considered good for many applications, did not meet the quality produced by the ektacolor print process.

(1) Dull Whites - The overall color quality is directly affected by the minimum density areas of the print, representing white. The print from the electrocolor process has dull whites and lacks brillance. This is a direct relation to the color quality. The present two methods used to preserve the image, have a definite dulling effect on the white areas of the print.

The first method is a heat laminating material which results in a loss of reflection of over 20%. Also this method tends to leave the white areas with a yellowish cast. The second and preferred method is to plastic coat the print. This method also reduces the reflection but the yellowing of the whites is not as apparent.

(2) Narrow Band Filters - The present electrocolor printer-processor utilizes three specific narrow band, red, green, and blue filters, corresponding to each of the individual tri-color exposures. It is possible that changing one or more of the narrow band filters, to other narrow band filters, possessing different spectral responses, could alter the image recording ability of each color plated, and hence change the color quality.

(3) Latent Image Deterioration - Latent image deterioration occurs rapidly after exposure. This effect has been determined by tests performed by both [redacted] and by the Center's photo lab. Although no extensive tests have been performed to determine the rate of deterioration, it has been established that the rate of image loss is directly proportional to an increase in room temperature and humidity. This deterioration positively relates to the color quality obtainable.

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d. Psychology of Color - There is a certain latitude or range of color balance that is considered "normal" color. The large degree of individual color contrast control capability, of the electrocolor system, renders this system capable of producing extremes in "abnormal" color balance. At present there is little known about what degree of color balance, in the print, could yield the most information for photo interpretation use. There is a possibility that "abnormal" color balance will yield more technical intelligence than "normal" color balance.

5. Conclusions

The present design of the electrocolor printer-processor greatly limits the use of the machine in the application of producing reconnaissance color prints. However, the electroplating color process concept merits recognition and its future uses may be invaluable. Although tests indicated that the saturation and fidelity of the colors do not meet the standards produced by other color print systems, it is very feasible that, with improvements in the electroplating techniques and in exposure techniques, the color quality of this product could match or surpass the quality of other existing systems.

6. Recommendations

a. That the existing rental contract on the electrocolor processor be terminated.

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b. That an unbiased research firm, such as [redacted] 25X1

25X1 [redacted] be contracted to perform a study to improve the quality of the electrocolor process. The study should include effort in the following areas:

(1) Latent Image Stability

(2) Dye Chemistry

(3) Plating Techniques and Efficiency

(4) Exposure Techniques - Narrow Band Filters - Use for abnormal color manipulation

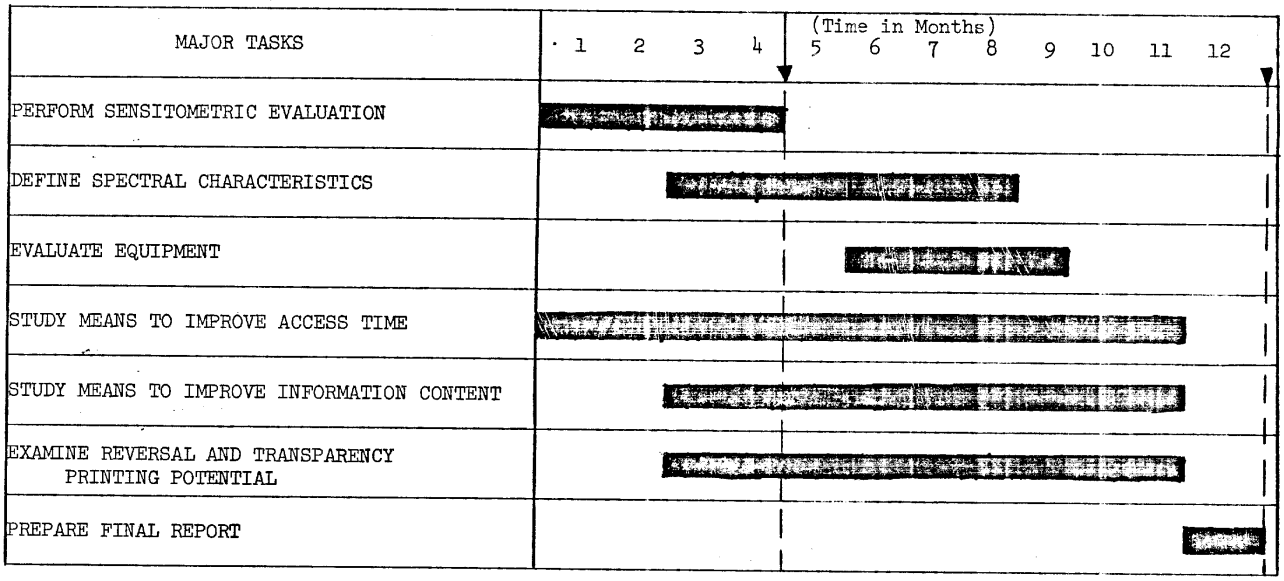
(5) Improved Product Resolution

(6) Improved Whites, Improved Method of Sustaining Image

(7) On design of pertinent equipment applying the electrocolor process.

ELECTROCOLOR MATERIALS STUDY --PROGRAM PHASING

TAB D
20 APRIL 1966



(Major Review Points ▼)

February 11, 1966

The purpose of this letter is to reflect the changes in the Technical Proposal No. 65-123A, as discussed by phone recently.

1. The evaluation of the present system will be a four month effort to provide current data regarding the limitations and capabilities of the Electrocolor System.

2. Concurrent with the evaluation will be an investigation into the potentials of electrophotographic systems. The major portion of this effort is programmed to be well along by the end of the fourth month so that a review at that point will indicate the direction and scope of the remainder of the investigation.

3. An additional effort is proposed to explore the potential of the electrophotographic system in the areas of exaggerated color, false color, spectral translation, spectral cueing, and other related applications. This effort will be under the direction of a human factors engineer.

4. The program schedule is designed to provide a broad investigation for the first four months, leaving some flexibility in the remainder of the phase. It is our feeling that at the four month review, sufficient data will be available to permit an efficient direction of effort for the remainder of Phase I.

5. The product of Phase I will be a document detailing: (1) the present capabilities of the system (2) the potential capabilities of the system, and (3) an

[redacted]

outline of the development program proposed for Phase II.

6. A program schedule and revised cost estimate is enclosed.

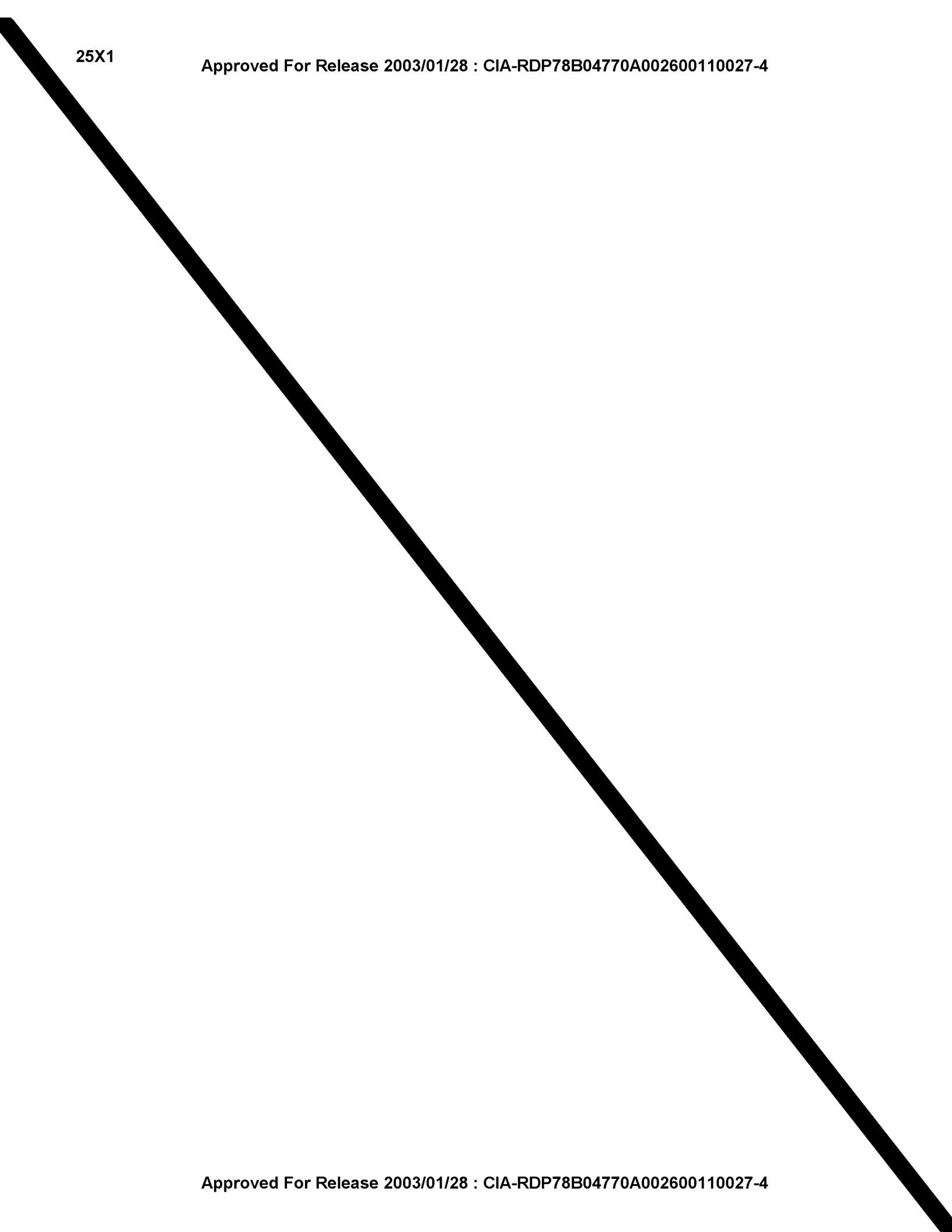
Feel free to contact me if we may be of further service to you.

Sincerely,

[redacted]

RC:bls

Encls:
Program Schedule
Cost Estimate



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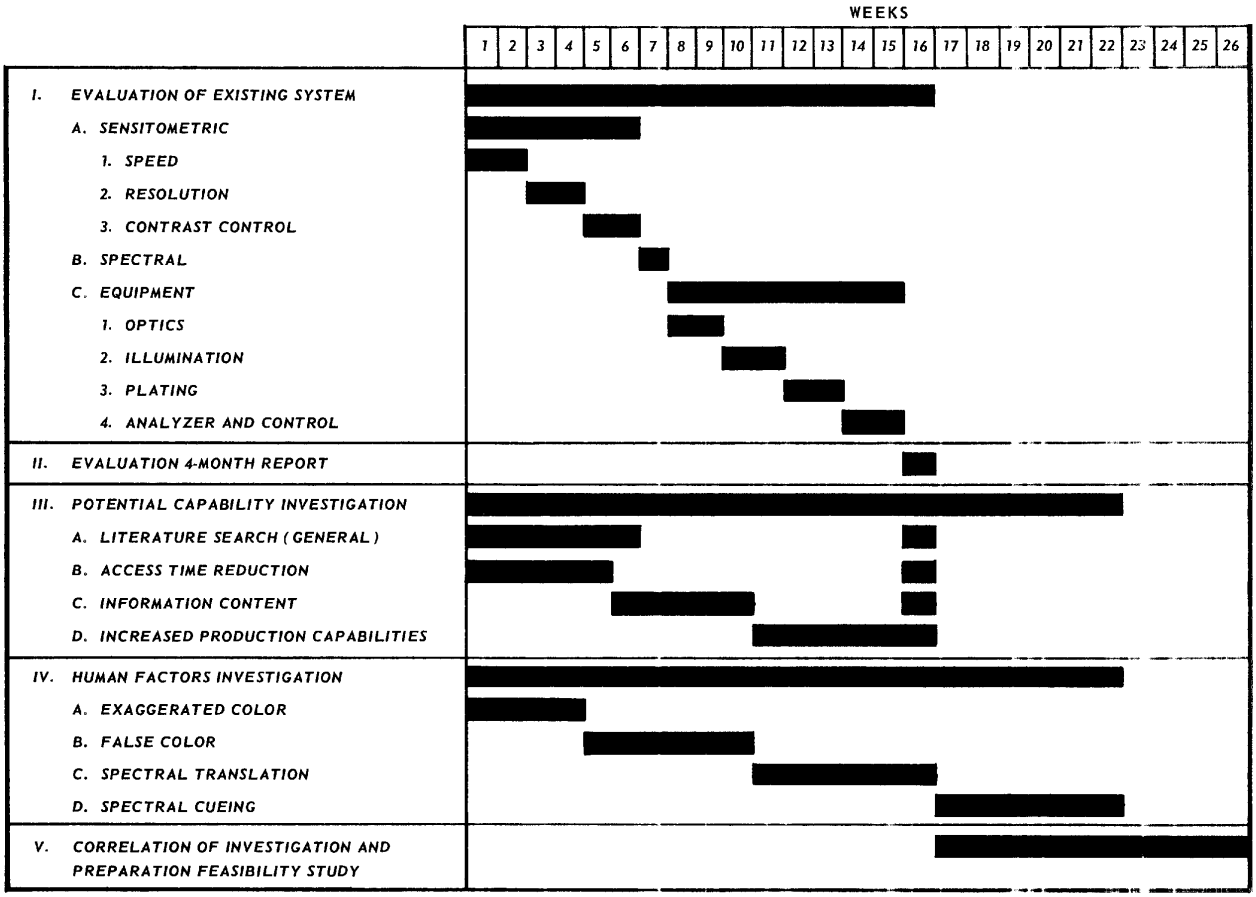
PROGRAM SCHEDULE



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